HIGHLIGHTED ARTICLES

[Assessing relative resilience potential of coral reefs to inform management](#)

Biological Conservation (3.762)

[Drifting to oblivion? Loss of genetic connectivity following fragmentation and drought in the Coachella Valley fringe-toed lizard](#)

Diversity and Distributions (3.667)

[Addressing fisheries bycatch in a changing world](#)

Frontiers in Marine Science (N/A)

[Linking transcriptional responses to organismal tolerance reveals mechanisms of thermal sensitivity in a mesothermal endangered fish](#)

Molecular Ecology (6.494)

[Joint projections of U.S. East Coast sea level and storm surge](#)

Nature Climate Change (14.547)

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Cross Line Office Publications

[Climatological distribution of aragonite saturation state in the global oceans](#)

Global Biogeochemical Cycles (3.965)

NOS Publications

[Seamounts, submarine channels, and new discoveries: benefits of continental shelf surveys extend beyond defining the limits of the shelf](#)

Journal of Ocean Technology (NA)

[Effects of ocean warming on growth and distribution of dinoflagellates associated with ciguatera fish poisoning in the Caribbean](#)

Ecological Modelling (2.321)

NMFS Publications

It takes guts to locate elusive crustacean prey

Marine Ecology Progress Series (2.64)

Reef relief and volume are predictors of Atlantic goliath grouper presence and abundance in the eastern Gulf of Mexico

Bulletin of Marine Science (1.475)

Potential sources of red snapper, *Lutjanus campechanus*, recruits estimated with Markov Chain Monte Carlo analysis of otolith chemical signatures

Marine and Freshwater Research (1.474)

Nesting population origins of leatherback turtles caught as bycatch in the U.S. pelagic longline fishery

Ecosphere (2.595)

Size scaling in western North Atlantic loggerhead turtles permits extrapolation between regions, but not life stages

PLoS One (3.534)

Identifying predictable foraging habitats for a wide-ranging marine predator using ensemble ecological niche models

Diversity and Distributions (3.667)

Success in rapidly restoring two failing oyster industries
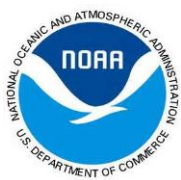
Journal of Shellfish Research (0.791)

First record of a leucistic *Narcine bancrofti* (Griffith & Smith, 1834) from the northern Gulf of Mexico

Cybium (0.58)

Towards an ecosystem-based approach of Guam's coral reefs: the human dimension

Marine Policy (2.621)

Towards individual-owned and owner-operated fleets in the Alaska halibut and sablefish IFQ program
Maritime Studies (n/a)

Wasp waist or beer belly? Modeling food web structure and energetic control in Alaskan marine ecosystems, with implications for fishing and environmental forcing
Progress in Oceanography (3.986)

Numerical integration of temperature-dependent functions in bioenergetics models to avoid overestimation of fish growth
Transactions of the American Fisheries Society (1.468)

Status of the world's baleen whales
Marine Mammal Science (1.936)

Bayesian logistic mixed-effects modelling of transect data: relating red tree coral presence to habitat characteristics
ICES Journal of Marine Science (2.525)

First assessment of the sex ratio for an East Pacific green sea turtle foraging aggregation: validation and application of a testosterone ELISA
PLoS One (3.534)

Development and field testing a satellite-linked fluorometer for marine vertebrates
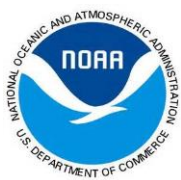Animal Biotelemetry (NA)

Development of baited predation event recorders to quantify juvenile Chinook salmon predation in a river environment
Fishery Bulletin (1.783)

OAR Publications
Forecasting impacts of Silver and Bighead Carp on the Lake Erie food web
Ecological Applications (4.126)

[Perspective of transient tracer applications and limiting cases](#)
Ocean Science (2.232)

[Occurrence and habitat use of the critically endangered smalltooth sawfish, *Pristis pectinata* Latham, 1794 in the Bahamas](#)
Journal of Fish Biology (1.734)

[The climate of the Pacific Arctic during the first RUSALCA decade 2004-2013](#)
Oceanography (3.285)

[Changes in the Lake Michigan food web following dreissenid mussel invasions: A synthesis](#)
Journal of Great Lakes Research (1.77)

[Estimating diffusivity from the mixed layer heat and salt balances in the North Pacific](#)
Journal of Geophysical Research: Oceans (3.44)

[Seasonality of tropical Pacific decadal trends associated with the 21st century global warming hiatus](#)
Journal of Geophysical Research (3.44)

OTHER REPORTS, BOOK CHAPTERS, AND INTERNAL PUBLICATIONS
[NOAA guidance document for determination of vertical land motion at water level stations using GPS technology](#)
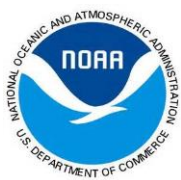NOAA Technical Report

HIGHLIGHTED ARTICLES
Assessing relative resilience potential of coral reefs to inform management
Biological Conservation (3.762)
J. A. Maynard, **S. McKagan (NMFS/HCD)**, L. Raymundo, S. Johnson, G. N. Ahmadia, L. Johnston, P. Houk, G. J. Williams, **M. Kendall (NOS/NCCOS)**, **S. F. Heron (NESDIS/CSAR)**, **R. van Hooidonk (OAR/AOML)**, E. Mcleod, D. Tracey, and S. Planes

- Offers guidance for assessing reef resilience to inform management.
- Includes a field case study from the Commonwealth of the Northern Mariana Islands that shows relative resilience potential can vary greatly.
- Herbivore biomass and coral recruitment are key resilience drivers in the Commonwealth.
- Expanding resilience assessments into vulnerability assessments is key for future work.

Ecological resilience assessments are an important part of resilience-based management and can help prioritize and target management actions. Use of such assessments has been limited due to a lack of clear guidance on the assessment process. This study builds on the latest scientific advances in resilience-based management to provide that guidance from a resilience assessment undertaken in the Commonwealth of the Northern Mariana Islands. We assessed spatial variation in ecological resilience potential at 78 forereef sites near the populated islands of the commonwealth: Saipan, Tinian/Aguijan, and Rota. The assessments are based on measuring indicators of resilience processes and are combined with information on anthropogenic stress and larval connectivity. We find great spatial variation in relative resilience potential with many high resilience sites near Saipan (five of seven) and low resilience sites near Rota (seven of nine). Criteria were developed to identify priority sites for six types of management actions (e.g., conservation, land-based sources of pollution reduction, and fishery management and enforcement) and 51 of the 78 sites met at least one of the sets of criteria. The connectivity simulations developed indicate Tinian/Aguijan are each roughly ten times the larvae source that Rota is and twice as frequent a destination. These results may explain the lower relative resilience potential of Rota reefs and indicates actions in Saipan and Tinian/Aguijan will be important to maintaining supply of larvae. The process we describe for undertaking resilience assessments can be tailored for use in coral reef areas globally and applied to other ecosystems.
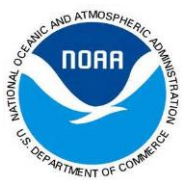Published: October 1, 2015
Available Online:
http://www.sciencedirect.com/science/article/pii/S0006320715300926

Drifting to oblivion? Loss of genetic connectivity following fragmentation and drought in the Coachella Valley fringe-toed lizard
Diversity and Distributions (3.667)

A. G. Vandergast, D. A. Wood, **A. R. Thompson (NMFS/SWFSC)**, M. Fisher, C. W. Barrows and T. Grant

- This is one of very few studies that sampled population genetic structure through time.
- Results suggest that managers should monitor genetic dynamics because species or populations may be vulnerable to extinction if genetic structure is compromised, and this vulnerability may not be evident through traditional census methods (i.e., merely counting individuals).
- Multiple stressors can very rapidly induce changes to the population genetics of rare species with relatively low abundance.

The frequency and severity of habitat alterations and disturbance are predicted to increase in upcoming decades, and understanding how disturbance affects population integrity is paramount for adaptive management. Although rarely is population genetic sampling conducted at multiple time points, pre- and post-disturbance comparisons may provide one of the clearest methods to measure these impacts. The authors examined how genetic diversity of the federally threatened Coachella Valley fringe-toed lizard (*Uma inornata*) responded to severe drought and habitat fragmentation across its range. Fragmentation and drought appear to have acted synergistically to induce genetic change over a short time frame. Progressive deterioration of connectivity, low Ne and measurable loss of genetic diversity suggest that conservation efforts have not maintained the genetic integrity of this species. Genetic sampling over time can help evaluate population trends to guide management.
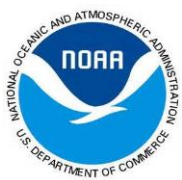Published: October 2015

Addressing fisheries bycatch in a changing world
Frontiers in Marine Science (N/A)
L. M. Komoroske (NMFS/SWFSC) and R. L. Lewison

- A review of advances in bycatch science and mitigation that serves as a resource for scientists and managers.
- A road map to guide future research and management projects to address the gaps and barriers that still remain and/or require additional attention.
- As the field of bycatch research moves into the 21st century, a new perspective is needed to develop responsive strategies that effectively

address the shifting ecological, social, cultural and economic contexts of the global bycatch seascape.

Fisheries bycatch is a threat to species of marine megafauna across the world's oceans. Work over the past several decades has greatly advanced our understanding of the species affected, the magnitude and the spatial extent of bycatch. In the same time period, there have been substantial advances in the development of mitigation strategies and best practices to reduce bycatch. In this paper, the authors summarize the state of bycatch knowledge and science to address the critical question "Where do we go from here?" They first review the current state of global bycatch science, including bycatch rate estimation and biological effects of bycatch, and bycatch mitigation practices and gear. Then the authors identify knowledge gaps as well as socio-cultural constraints that hamper effective knowledge transfer or implementation, and discuss emerging transdisciplinary approaches to address these issues. Finally, the need to consider bycatch in a changing ocean and socio-cultural context where species, ecosystems, and people are responding to multiple stressors and dynamic conditions is discussed.
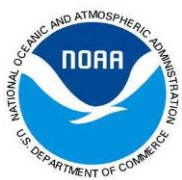
Acceptance date: 29 September 2015

Linking transcriptional responses to organismal tolerance reveals mechanisms of thermal sensitivity in a mesothermal endangered fish
Molecular Ecology (6.494)
L. M. Komoroske (NMFS/SWFSC), R. E. Connon, K. M. Jeffries, and N. A. Fangue

- Provides evidence for need to incorporate sublethal physiological stress into management
- Suggests that the acclimation capacity of mesothermal fishes to cope with climate change may be limited
- Argues that the underlying thermal physiology of mesothermal fishes may be different than those that can tolerate wide ranges of temperatures (which currently provides the bulk of the knowledge for the field)

Forecasting species' responses to climate change requires understanding the underlying mechanisms governing environmental stress tolerance, including acclimation capacity and acute stress responses. Current knowledge of these physiological processes in aquatic ectotherms is largely drawn from eurythermal or

extreme stenothermal species. Yet many species of conservation concern exhibit tolerance windows and acclimation capacities in between these extremes. We linked transcriptome profiles to organismal tolerance in a mesothermal endangered fish, the delta smelt, *(Hypomesus transpacificus),* to quantify the cellular processes, sublethal thresholds and effects of thermal acclimation on acute stress responses. Delta smelt initiated rapid molecular changes in line with expectations of theoretical thermal limitation models, but also exhibited diminished capacity to modify expression of some genes and cellular mechanisms key to coping with acute thermal stress found in eurytherms. Sublethal critical thresholds occurred 4-6°C below their upper tolerance limits, and thermal acclimation shifted the onset of acute thermal stress and tolerance as predicted. However, we found evidence that delta smelt's limited thermal plasticity may be partially due to an inability of individuals to effectively make physiological adjustments to truly achieve new homeostasis under heightened temperatures, resulting in chronic thermal stress. These findings provide insight into the physiological basis of the diverse patterns of thermal tolerances observed in nature. Moreover, understanding how underlying molecular mechanisms shape thermal acclimation capacity, acute stress responses, and ultimately differential phenotypes, contributes to a predictive framework to deduce species' responses *in situ* to changes in selective pressures due to climate change.
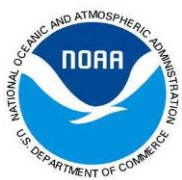Accepted: 20 August 2015

Joint projections of U.S. East Coast sea level and storm surge
Nature Climate Change (14.547)
C. M. Little, R. M. Horton, R. E. Kopp, M. Oppenheimer, **G. A. Vecchi (OAR/CPO),** and G. Villarini
  ● This paper expands the set of techniques used for assessing coastal flood risk by creating an index that is replicable and possible to operationalize so it can be one of several consistent metrics for projecting coastal flood risk.
  ● The authors project a substantial increase in flood hazard risk on the East Coast throughout this century.
Future coastal flood risk will be strongly influenced by sea-level rise (SLR) and changes in the frequency and intensity of tropical cyclones. These two factors are generally considered independently. Here, we assess twenty-first century changes in the coastal hazard for the US East Coast using a flood index (FI) that accounts

for changes in flood duration and magnitude driven by SLR and changes in power dissipation index (PDI, an integrated measure of tropical cyclone intensity, frequency and duration). Sea-level rise and PDI are derived from representative concentration pathway (RCP) simulations of 15 atmosphere–ocean general circulation models (AOGCMs). By 2080–2099, projected changes in the FI relative to 1986–2005 are substantial and positively skewed: a 10th–90th percentile range 4–75 times higher for RCP 2.6 and 35–350 times higher for RCP 8.5. High-end FI projections are driven by three AOGCMs that project the largest increases in SLR, PDI and upper ocean temperatures. Changes in PDI are particularly influential if their intra-model correlation with SLR is included, increasing the RCP 8.5 90th percentile FI by a further 25%. Sea-level rise from other, possibly correlated, climate processes (for example, ice sheet and glacier mass changes) will further increase coastal flood risk and should be accounted for in comprehensive assessments.

Publication date: 21 September 2015

Available online:

http://www.nature.com/nclimate/journal/vaop/ncurrent/full/nclimate2801.html
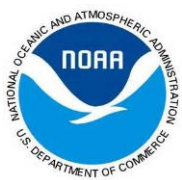
ADDITIONAL ARTICLES

Cross Line Office Publications

Climatological distribution of aragonite saturation state in the global oceans
Global Biogeochemical Cycles (3.965)
L. Jiang, **R. A. Feely (OAR/PMEL),** B. R. Carter**, D. J. Greeley (OAR/PMEL), Dwight K. Gledhill (OAR/OAP), Krisa M. Arzayus (NESDIS/NCEI)**

- This study calculated the aragonite saturation state (Ωarag) in surface and subsurface waters of the global oceans
- Aragonite saturation state measures the solubility of aragonite, and is used frequently in studies of ocean acidification
- This study found that aragonite saturation decreased in the Atlantic and Pacific Oceans in waters shallower than 100 m depth from the decade spanning 1989–1998 to the decade spanning 1998–2010.

Aragonite saturation state (Ωarag) in surface and subsurface waters of the global oceans was calculated from up-to-date (through the year of 2012) ocean station dissolved inorganic carbon (DIC) and total alkalinity (TA) data. Surface Ωarag in

the open ocean was always supersaturated ($\Omega>1$), ranging between 1.1 and 4.2. It was above 2.0 (2.0-4.2) between 40°N and 40°S, but decreased towards higher latitude to below 1.5 in polar areas. The influences of water temperature on the TA/DIC ratio, combined with the temperature effects on inorganic carbon equilibrium and apparent solubility product (K'sp), explain the latitudinal differences in surface Ωarag. Vertically, Ωarag was highest in the surface mixed layer (SML). Higher hydrostatic pressure, lower water temperature, and more CO_2 buildup from biological activity in the absence of air-sea gas exchange helped maintain lower Ωarag in the deep ocean. Below the thermocline, aerobic decomposition of organic matter along the pathway of global thermohaline circulation played an important role in controlling Ωarag distributions. Seasonally, surface Ωarag above 30° latitudes was about 0.06 to 0.55 higher during warmer months than during colder months in the open-ocean waters of both hemispheres. Decadal changes of Ωarag in the Atlantic and Pacific Oceans showed that Ωarag in waters shallower than 100 m depth decreased by 0.10±0.09 (−0.40±0.37% yr−1) on average from the decade spanning 1989–1998 to the decade spanning 1998–2010.

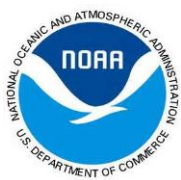Accepted: October 2015

NOS Publications

Seamounts, submarine channels, and new discoveries: benefits of continental shelf surveys extend beyond defining the limits of the shelf
Journal of Ocean Technology (NA)
A. Armstrong (NOS/OCS), L. Mayer, and J. Gardner
  ● Results and highlights from the interagency U.S. Extended Continental Shelf Project are described.
The interagency U.S. Extended Continental Shelf Project bathymetric mapping effort, led by NOAA, is one of the largest civil ocean mapping projects ever undertaken. This essay describes some of the bathymetric mapping results from the project, highlights some of the interesting seafloor features discovered by the mapping, notes the value of this mapping for charting, resource management, and scientific purposes, and emphasizes the importance of proper surveying procedures in obtaining high-quality results. Modern, full-coverage multibeam echo sounding has been a transformative technology for mapping our oceans, but without the rigorous procedures and quality control used in this project, multibeam data can be

distorted by systematic and random errors and artifacts. Interpreting poor data can lead to missed discoveries and unfounded conclusions.
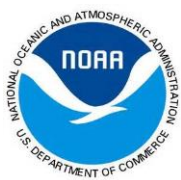Expected Publication Date: October 2015

Effects of ocean warming on growth and distribution of dinoflagellates associated with ciguatera fish poisoning in the Caribbean
Ecological Modelling (2.321)
S. R. Kibler, P. A. Tester, K. E. Kunkel, S. K. Moore, and **R. W. Litaker (NOS/NCCOS)**

- Rising temperatures through 2099 are projected to increase the abundance, diversity and distribution of Ciguatera-associated dinoflagellates in the Gulf of Mexico and southeast U.S. Atlantic coast.
- Levels will likely remain constant or decrease slightly in the Caribbean Sea.

Projected water temperatures at six sites in the Gulf of Mexico and Caribbean Sea were used to forecast potential effects of climate change on the growth, abundance, and distribution of *Gambierdiscus* and *Fukuyoa* species, dinoflagellates associated with ciguatera fish poisoning (CFP). Data from six sites in the Greater Caribbean were used to create statistically downscaled projections of water temperature using an ensemble of eleven global climate models and simulation RCP6.0 from the WCRP Coupled Model Inter-comparison Project Phase 5. Growth rates of five dinoflagellate species were estimated through the end of the 21st century using experimentally-derived temperature vs. growth relationships for multiple strains of each species. The projected growth rates suggest the distribution and abundance of CFP-associated dinoflagellate species will shift substantially through 2099. Rising water temperatures are projected to increase the abundance and diversity of *Gambierdiscus* and *Fukuyoa* species in the Gulf of Mexico and along the U.S. southeast Atlantic coast. In the Caribbean Sea, where the highest average temperatures correlate with the highest rates of CFP, it is projected that *Gambierdiscus caribaeus*, *Gambierdiscus belizeanus* and *Fukuyoa ruetzleri* will become increasingly dominant. Conversely, *Gambierdiscus carolinianus* and *Gambierdiscus* ribotype 2, which are adapted to lower temperatures, are likely to become less prevalent in the Caribbean Sea and are expected to expand their ranges in the northern Gulf of Mexico and farther into the western Atlantic. The risks associated with CFP are also expected to change regionally, with higher

incidence rates in the Gulf of Mexico and U.S. southeast Atlantic coast, with stable or slightly lower risks in the Caribbean Sea.

Publication Date: 24 November 2015

Available online:

http://www.sciencedirect.com/science/article/pii/S030438001500383X

NMFS Publications

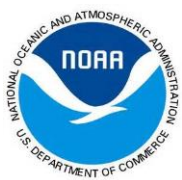*It takes guts to locate elusive crustacean prey*

Marine Ecology Progress Series (2.64)

R. Lasley-Rasher, D. Brady, **B. E. Smith (NMFS/NEFSC)**, P. Jumars

- Fish diets are practical samplers of mobile crustacean shrimps (i.e. crangonids, euphausiids, mysids, and pandalids) over large spatial scales.
- These prey are important to a wide variety of juvenile and adult demersal fishes on the NE US continental shelf.
- Feeding patterns infer shrimp migrations, demonstrating mysids and crangons move into shallower water from February to March, and euphausiids and pandalids shift their distributions northward during March.

Mobile crustacean prey, i.e., crangonids, euphausiids, mysids, and pandalids, are vital links in marine food webs. Their intermediate sizes and characteristic caridoid escape responses lead to chronic underestimation when sampling at large spatial scales with either plankton nets or large trawl nets. Here, as discrete sampling units, we utilize individual fish diets (i.e., fish biosamplers) collected by the U.S. National Marine Fisheries Service and Northeast Fisheries Science Center to examine abundance and location of these prey families over large spatial and temporal scales in the northeastern U.S. shelf large ecosystem. We found these prey families to be important to a wide variety of both juvenile and adult demersal fishes from Cape Hatteras to the Scotian Shelf. Fish biosamplers further revealed significant spatial shifts in prey in early spring. Distributions of mysids and crangonids in fish diets shoaled significantly from February to March. Distributions of euphausiids and pandalids in fish diets shifted northward during March. Of multiple hypotheses for these shifts, prey migration is most strongly supported.

Accepted: September 2015

Reef relief and volume are predictors of Atlantic goliath grouper presence and abundance in the eastern Gulf of Mexico
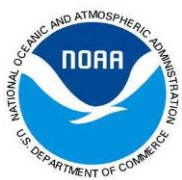
Bulletin of Marine Science (1.475)

A. B. Collins, L. R. Barbieri, **R. S. McBride (NMFS NEFSC),** E. D. McCoy, and P. J. Motta

- This study examined presence, abundance, and size distribution of goliath grouper during monthly underwater visual surveys on the northern edge of their distributional range in the Gulf of Mexico.
- The strong site fidelity of goliath grouper combined with their continuous and predictable association with artificial reefs allows for relatively efficient monitoring of individuals within a given region; however, these traits also increase vulnerability to exploitation and underline the need for cautious management.
- The fishery for this species is highly regulated, including a moratorium on landings, and the information herein aids in designing a monitoring program and interpreting related data.

Atlantic goliath grouper, *Epinephelus itajara* (Lichtenstein, 1822), presence, abundance, and size distribution were assessed during monthly underwater visual surveys at natural and artificial reefs in the central eastern Gulf of Mexico (7–50 m depth). Atlantic goliath grouper were more likely to be present, and to occur in greater abundance, at artificial reefs. Abundance was positively related to vertical relief and structural volume, and the largest numbers of individuals were observed at high volume artificial reefs (e.g., shipwrecks). This was likely due to greater refuge availability provided by artificial reefs within the study region, where structurally comparable natural habitats are rare. Atlantic goliath grouper measured via underwater video ranged in size from 36 to 214 cm total length (TL; median = 121 cm). No relationship was observed between TL and site depth or reef type. Tagged individuals were documented to move distances ranging 10–203 km, but the majority of tag return data indicated high site fidelity. The strong site fidelity of goliath grouper combined with their continuous and predictable association with artificial reefs allows for relatively efficient monitoring of individuals within a given region; however, these traits also increase vulnerability to exploitation and underline the need for cautious management.
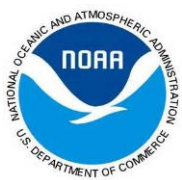
Potential sources of red snapper, Lutjanus campechanus*, recruits estimated with Markov Chain Monte Carlo analysis of otolith chemical signatures*
Marine and Freshwater Research (1.474)
B. K. Barnett (NMFS/SEFSC), W. F. Patterson, III, **T. Kellison (NMFS/SEFSC)**, S. B. Garner, and A. M. Shiller

- Although evidence exists that red snapper population in the U.S. South Atlantic waters have a center of abundance off northeast Florida, results from otolith chemical analysis suggest more than one nursery source contributing recruits for red snapper age classes 2 – 5 years.
- Otolith chemical signatures showed less variability for fish collected at lower latitudes, suggesting local self-recruitment for red snapper (age < 4 years) in the south; whereas, signatures for 4 and 5 year old fish collected at higher latitudes showed overlap with signatures from lower latitudes, suggesting that fish from southern nursery areas moved northward with age.
- Increased mixing of southern fish with northern fish was apparent among latitudes as fish grew older and the direction of mixing appears to be northward away from the center of abundance off northeast Florida.

Otolith chemical signatures were employed to estimate the number of likely nursery sources that contributed recruits to a suite of red snapper, *Lutjanus campechanus*, year classes sampled in 2012 in U.S. Atlantic Ocean waters from southern Florida (28°N) to North Carolina (34°N). Otoliths from subadult and adult fish (N = 139; ages 2-5 years) were cored and their chemical constituents analyzed for $\delta^{13}C$, $\delta^{18}O$, Ba:Ca, Mg:Ca, Mn:Ca, and Sr:Ca. Results from multiple linear regression analyses indicated that there was significant latitudinal variation for $\delta^{13}C$, Ba:Ca, Mg:Ca, and Mn:Ca. Therefore, these variables were used to parameterize Markov Chain Monte Carlo (MCMC) models computed to estimate the most likely number of nursery sources to each age class. Results from MCMC models indicated that between 2 and 7 nursery sources were equally plausible among the 4 age classes examined, but the likely number of nursery sources declined for age-4 and age-5 fish due to apparent mixing between more northern and more southern signatures. Overall, there is evidence to reject the null hypothesis that a single nursery source contributed recruits among the age classes examined, but increased sample size from a broader geographic range may be required to refine estimates of the likely number of nursery sources.
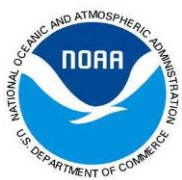
Nesting population origins of leatherback turtles caught as bycatch in the U.S. pelagic longline fishery
Ecosphere (2.595)

K. R. Stewary, E. L. LaCasella, S. E. Roden, M. P. Jensen, L. W. Stokes, S. P. Epperly, and P. H. Dutton (NMFS/SWFSC)

- A disproportionate number of the leatherback turtles (*Dermochelys coriacea*) detected in western North Atlantic U.S. pelagic longline fishery bycatch were from Costa Rica nesting stocks.
- Costa Rican populations are one of the only populations in the northern Atlantic that is not experiencing significant increases in nest numbers.
- No turtles from African rookeries were detected in U.S. pelagic longline fishery bycatch, lending further evidence that African nesting stocks forage elsewhere and may not be affected by western North Atlantic fisheries.

Fisheries that operate at large spatial scales and with high intensity have the potential to impact highly migratory species, and it is important to characterize threats to specific breeding populations of these species. We used many-to-many mixed-stock analysis (MSA) (n = 408) and microsatellite assignment testing (n = 397) to determine source populations for leatherback turtles (*Dermochelys coriacea*) caught as bycatch in the U.S. pelagic longline fishery from 2002 to 2012 in the western North Atlantic. Within the U.S., we had bycatch samples from the majority of statistical fishing areas: Gulf of Mexico (GOM), Northeast Distant (NED), Caribbean (CAR), Florida East Coast (FEC), Mid Atlantic Bight (MAB), Northeast Coastal (NEC), South Atlantic Bight (SAB) and Sargasso (SAR). We determined the proportions of turtles from each of nine nesting stocks in the Atlantic in each of the sampled areas. These nesting stocks included Brazil, Costa Rica, Florida, Trinidad, French Guiana, St. Croix, Ghana, Gabon and South Africa. The MSA revealed that the NED had a lower relative proportion of turtles from Costa Rica than other areas and that the GOM had the highest relative proportion of turtles from Costa Rica. No turtles were assigned to the African rookeries, lending further evidence that turtles from that region forage elsewhere and therefore may not be affected by western North Atlantic fisheries. This work contributes to the ongoing assessment of threats to leatherback turtles in the Regional Management Unit (RMU) of the western North Atlantic, and draws

attention to the disproportionate number of turtles being caught from Costa Rica, which is one of the only populations in the northern Atlantic that is not experiencing significant increases in nest numbers. This approach should be useful in determining population-specific threats to other highly migratory protected species that may depend on segregated foraging areas either within or between species.

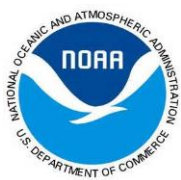*Size scaling in western North Atlantic loggerhead turtles permits extrapolation between regions, but not life stages*

N. Marn, T. Klanjscek, **L. Stokes (NMFS/SEFSC)**, and M. Jusup

- Allometry and scaling models greatly aid sea turtle conservation, however, scaling methods may differ between life stages and/or regions.
- Differences between scaling relationships in different regions of the western North Atlantic for loggerheads are negligible.
- Using models fitted on data from different life stages for loggerheads is not recommended.
- There were no considerable differences in the performance of linear and saturating models for scaling.

Sea turtles face threats globally and are protected by national and international laws. Allometry and scaling models greatly aid sea turtle conservation and research, and help to better understand the biology of sea turtles. Scaling, however, may differ between life stages and/or regions. We analyze differences between data from (i) two different regional subsets and (ii) three different life stage subsets of the western North Atlantic loggerhead turtles, and discuss the implications. Results suggest that the differences between scaling relationships of different regions are negligible, and models fitted on data from one region of the western North Atlantic can safely be used on data for the same life stage from another region. On the other hand, using models fitted on data for one life stage to describe other life stages is not recommended if accuracy is of paramount importance. In particular, posthatchlings and oceanic juveniles should be studied and modeled separately whenever practical, while neritic juveniles and adults can be modeled together as one group. As a general description of scaling, a common model for all life stages can be used, and isometric growth can be assumed. In addition to traditionally used

linear models for scaling, we test the performance of a saturating model. There is no considerable difference in the performance of the two types of models.
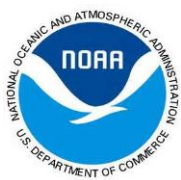Acceptance date: 22 September 2015

Identifying predictable foraging habitats for a wide-ranging marine predator using ensemble ecological niche models
Diversity and Distributions (3.667)
K. L. Scales, P. I. Miller, S. N. Ingram, **E. L. Hazen**, **S. J. Bograd**
(NMFS/SWFSC), and R. A. Phillips

- Ensemble ecological niche model (EENM) techniques are useful for reducing potential biases in spatial predictions of habitat suitability that result from single-algorithm models.
- The authors highlight the potential of EENM coupled with movement data as a tool for identifying at-sea habitats of wide-ranging marine predators, with clear implications for conservation and management.

Ecological niche modelling can provide valuable insight into the environmental preferences of wide-ranging species, and can aid identification of key habitats for populations of conservation concern. Here, we integrate biologging, satellite remote-sensing and ensemble ecological niche models (EENM) to identify predictable foraging habitats for a globally important population of the grey-headed albatross (GHA) *Thalassarche chrysostoma*. GPS and geolocation-immersion loggers were used to track the at-sea movement and activity patterns of GHA over two breeding seasons (n=55; brood-guard phase). Immersion frequency (landings per ten-minute interval) was used to identify foraging events. An EENM combining predictions of Generalised Additive Models (GAM), MaxEnt, Random Forest (RF) and Boosted Regression Trees (BRT) identified the biophysical conditions characterising the locations of foraging events, using a suite of time-matched oceanographic predictors. Model performance was assessed through iterative cross-validation, and extrapolative performance investigated through cross-validation among years. Foraging habitats identified by EENM spanned neritic (<500m), shelf-break and oceanic waters, and were associated with particular SST ranges (3-8°C, 12-13°C), productive regions (chl-a > 0.5mg m-3) and the Antarctic Polar Frontal Zone (APFZ; TFreq > 25%). Predictable foraging habitats identified by EENM appear to be co-located with a set of persistent biophysical conditions characterised by particular thermal ranges (3-8°C, 12-

13°C), and elevated primary productivity (chl-a > 0.5mg m-3). Over the spatial and temporal scales investigated by our models, overall performance of EENM was superior to that of single-algorithm models (GAM, RF, BRT, MaxEnt). EENMs also displayed good extrapolative performance when cross-validated among years.

Acceptance date: 21 September 15

Success in rapidly restoring two failing oyster industries
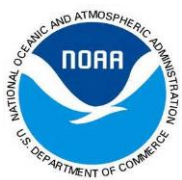Journal of Shellfish Research (0.791)
C. L. MacKenzie, Jr. (NMFS/NEFSC)

- In two highlighted case studies, identification of factors limiting oyster production and taking immediate actions to reduce their effects was done with the cooperation of oystermen and public resource administrators.
- One oyster industry in the Long Island Sound in Connecticut-New York, saw oyster landings increased 5.6 fold between 1965 to 1975 using this holistic management approach.
- The holistic management approach increased fishermen from 200 to 500-600 in another oyster industry on Prince Edward Island in eastern Canada.

Practical and aggressive programs were developed and implemented that enhanced the productivity of two oyster industries, whose landings had been declining for many years. One industry was in Connecticut-New York, Long Island Sound, and the other was on Prince Edward Island (PEI), eastern Canada. The programs featured using scuba observations to identify factors that limited oyster abundances on the beds and then working with oystermen to take immediate steps to reduce their effects. Counts were made of live and dead oysters. The causes of each type of mortality were identified and enumerated. Tables and graphs showed when and how the mortalities were occurring. The Connecticut-New York Landings showed a 5.6 fold increase between 1965, just before the program began, to 1975. Individual PEI oystermen did not increase their harvests, but employment in the fishery increased from 200 to 500-700 men. The two programs showed that oyster abundances and their landings can be raised rapidly in oyster industries under both private and public control by an approach that features solving immediate production problems while using a holistic management approach.

Expected Publication date: 1 December 2015

First record of a leucistic Narcine bancrofti *(Griffith & Smith, 1834) from the northern Gulf of Mexico*

Cybium (0.58)

C. M. Jones, **E. R. Hoffmayer (NMFS/SEFSC)**, and R. P. Gropp

- First report of a leucistic ray without morphological abnormalities with the exception of pigmentation.
- This report represents another record of leucism in chondricthyes as well as additional information on associated abnormalities.

Here the authors report on the first record of leucism in *Narcine bancrofti*. The leucistic ray, an immature male, was captured with 21 conspecifics exhibiting normal coloration for the species. Nineteen of these animals, including the leucistic ray, were retained for further examination. A suite of twelve morphometrics were measured on each ray and regressed against total length in an effort to determine if additional morphological abnormalities were present. In each case, the leucistic ray exhibited similar relative proportions to the normally colored rays.
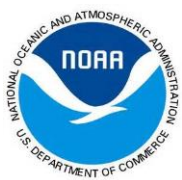
Acceptance date: 22 September 2015

Towards an Ecosystem-based approach of Guam's coral reefs: the human dimension

Marine Policy (2.621)

M. Weijerman, C. Grace-McCaskey, S. Grafeld, **D. Kotowicz (NMFS/PIFSC),** K. L. Oleson, and I. van Putten

- Balanced strategies for ecosystem monitoring, analysis and conservation are needed to optimize long-term benefits across diverse user groups.
- Linkage of ecosystem models with models of human behavior provides enhanced insights and guidance for management.

Management of tropical reef ecosystems under pressure from terrestrial and extractive marine activities is not straightforward, especially when the interests of extractive and non-extractive marine resource sectors compete. Before implementing management actions, potential outcomes of alternative management strategies can be evaluated in order to avoid adverse or unintended consequences. In tropical reef ecosystems the continued existence of the cultural and recreational fishing activities and the economically important dive-based tourism and recreation industry rest on sustainably managed marine resources. Through a case study of Guam, an ecosystem model was linked with human behavior models for

participation in fishing and diving to evaluate future socio-ecological impacts of different management options. Ecosystem indices for reef status and resilience, and extraction potential were identified to evaluate the performance of alternative management scenarios. These marine ecosystem indices link the natural system to human uses (fishing and dive-based tourism and recreation). Evaluating management scenarios indicates that applying a single management tool, such as, input controls or marine preserves, without also managing the watershed, is suboptimal. Combining different management tools has negative near-term costs, particularly for the fishing sector, but these are likely to be outweighed by the long-term benefits obtained from greater species abundance. Adopting watershed management measures in addition to fishery regulations distributes the burden for improving the reef status across multiple sectors that contribute to reef pressures.
Acceptance date: 24 September 2015
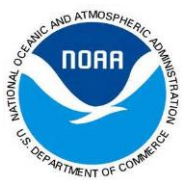Expected publication date: early 2016

Towards individual-owned and owner-operated fleets in the Alaska halibut and sablefish IFQ program
Maritime Studies (n/a)
M. Szymkowiak and **A. Himes-Cornell (NMFS/AKFSC)**
- Limits on corporate ownership of quota shares have been largely successful in providing for a transition of shareholdings to individuals.
- In contrast, the transition to owner-operators has been slowed by the allowance of hired skipper use by initial recipients.
- As a group, corporate entities have divested themselves of their quota shareholdings across all of the regulatory areas in both of the IFQ fisheries, with individuals now holding the majority of the quota shares in nearly all areas.
- Management needs to be adaptive to the changing realities in a fishery and to the likelihood that fishery participants will exploit loopholes if sufficient economic incentives exist to do so.

This paper presents an assessment of the impacts of active participation measures in the Alaska halibut and sablefish individual fishing quota (IFQ) program. These measures include a prohibition on IFQ leasing, limitations on the acquisition of quota shares by corporate entities, and restrictions on the use of hired skippers. The goals of these measures were to limit the entrance of investment speculators and to

provide for an ultimate transition to wholly individual-owned and owner-operated fleets. In an effort to maintain a historically owner-operated fleet and to facilitate entry into the fisheries, in area 2C and the Southeast Outside regulatory area of the halibut and sablefish fisheries, respectively, the use of hired skippers was limited to corporate entities and quota share acquisition was limited to individuals. This paper examines the impacts of both the program-wide and the Southeast Alaska-specific measures. With regards to the program-wide measures, despite the migration of quota shares from corporate entities to individuals, the transition to wholly owner-operated fleets has been slowed by the consolidation of quota shares by individual initial recipients, who are increasingly using hired skippers. With regards to the Southeast Alaska-specific provisions, the use of hired skippers is significantly lower than in the other areas; however, entry into the fisheries for second-generation quota shareholders is on par with other regulatory areas. The experience with the active participation measures in the IFQ program demonstrates that initial recipient shareholders have large incentives to retain their shares and hire skippers to fish their IFQ rather than to sell their quota. As a result, there is a need for management to be amendable in order to address potential loopholes in regulations. There is also anecdotal evidence of differing cultural contexts for hired skipper use and second-generation entry between the Seattle and Alaska-based fleets. Wherein acting as a hired skipper may be analogous to an apprenticeship that facilitates quota share purchase in the Seattle fleet, Alaskan hired skippers may be more analogous to strict lessees, who ultimately compete for quota shares in a market that includes both initial recipients and second-generation shareholders, who were gifted quota shares.
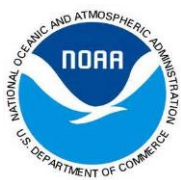
Acceptance date: 15 September 2015
Expected publication date: Late 2015

Wasp waist or beer belly? Modeling food web structure and energetic control in Alaskan marine ecosystems, with implications for fishing and environmental forcing
Progress in Oceanography (3.986)
S. Gaichas (NMFS/NEFSC), K. Aydin (NMFS/AFSC), and R. Francis
- Identifying structural properties of fished food webs is important for sustainable fisheries management.

- The results of identical pollock fishing and climate-driven pollock recruitment simulations in the Eastern Bering Sea and Gulf of Alaska show different system responses.

The Eastern Bering Sea (EBS) and Gulf of Alaska (GOA) continental shelf ecosystems show some similar and some distinctive groundfish biomass dynamics. Given that similar species occupy these regions and fisheries management is also comparable, similarities might be expected, but to what can we attribute the differences? Different types of ecosystem structure and control (e.g. top-down, bottom-up, mixed) can imply different ecosystem dynamics and climate interactions. Further, the structural type identified for a given ecosystem may suggest optimal management for sustainable fishing. Here, the authors use information on the current ecosystem state derived from food web models of both the EBS and the GOA combined with dynamic ecosystem models incorporating uncertainty to classify each ecosystem by its structural type, then suggest how this structure might be generally related to dynamics and predictability. The results of the analysis suggest that the EBS and GOA have fundamentally different food web structures overall. When viewed from the perspective of the same commercially and ecologically important species in each system (e.g. walleye pollock [*Gadus chalcogrammus*]), the EBS food web structure centers on a large mass of pollock, which appears to contribute to relative system stability and predictability, while the GOA food web structure features high predator biomass that contributes to a more dynamic, less predictable ecosystem. Mechanisms for climate influence on pollock production in the EBS are increasingly understood, while climate forcing mechanisms contributing to the potentially destabilizing high predator biomass in the GOA remain enigmatic. Here the authors present results of identical pollock fishing and climate-driven pollock recruitment simulations in the EBS and GOA which show different system responses, again with less predictable response in the GOA. Overall, these results suggest that identifying structural properties of fished food webs is as important for sustainable fisheries management as attempting to predict climate and fisheries effects within each ecosystem.

Acceptance date: 27 September 2015

Expected publication date: December 2015

Occurrence and habitat use of the critically endangered smalltooth sawfish, Pristis pectinata *Latham, 1794 in the Bahamas*

Journal of Fish Biology (1.734)

T.L. Guttridge, **S.J.B. Gulak**, B.R. Franks, **J.K. Carlson**, S.H. Gruber, K.S. Gledhill, M.E. Bond, G. Johnson, R.D. Grubbs (**SEFSC Panama City Laboratory**)

- The Bahamas may represent one of the last remaining areas where smalltooth sawfish are found in the NW Atlantic Ocean outside the United States.
- Andros Island was identified as the most probable area for breeding and pupping in the Bahamas
- Further research remains to determine if smalltooth sawfish emigrate to the United States and whether those in the United States immigrate to the Bahamas.

The smalltooth sawfish, *Pristis pectinata*, is a rarely encountered species that is listed as critically endangered by the IUCN Red List of threatened species. In the U.S.A. it is afforded specific protection, and listed as endangered under the federal Endangered Species Act. Importantly, this led to the implementation of a recovery plan and identification of shallow water, mangrove-fringed coastal areas as critical habitats for juveniles. However, despite this improved knowledge, little is known about this species outside of U.S.A waters, although neighboring countries (e.g. Bahamas) have reliable sightings and suitable habitat. This study documents and discusses recent (2002- 2015) sightings and captures of *P. pectinata* in the Bahamas. It examines movement patterns and habitat preferences of five *P. pectinata*: two tracked with acoustic telemetry in Bimini, and three tagged with pop-up archival transmitting tags in Andros. Historically, *P. pectinata* may have been distributed throughout the Bahamas, however since 2002 only 65 encounters were recorded including: Grand Bahama (1), Eleuthera (1), Long Island (1), Berry Islands (1); Harbour Island (1), Exuma (2), New Providence (1), Abaco (2), Cat Cay (3), Bimini (15) and Andros (37). In Bimini all P. pectinata were >225cm (Ls) suggesting that it is not used as a nursery area. Those in Andros ranged from ~80-450cm (Ls) indicating that this island might be an important nursery and breeding habitat. P. pectinata tracked in both islands remained at depths < 3m, often adjacent to mangrove habitats, displaying residency from 42 days (Bimini) to 180 days (Andros). These preliminary findings confirm the potential of the Bahamas as an important habitat for P. pectinata and emphasize the urgent need for protection and management of this population.

Accepted: 24 September 2015

*Numerical integration of temperature-dependent functions in bioenergetics models to avoid overestimation of fish growt*h

Transactions of the American Fisheries Society (1.468)

K. Holsman and **E. Danner (NMFS/SWFSC)**

- Found that using the non-linear temperature-dependent algorithms for consumption and respiration results in a large difference between the daily and sub-daily model estimates of growth

The "Wisconsin" bioenergetics model is widely used to evaluate the effects of environmental conditions, trophic interactions, and human-mediated alterations to physical and trophodynamic processes on the growth and survival of individual fish species. In particular, bioenergetics models are increasingly applied to evaluate conditions that vary on sub-daily time-steps, such as vertical migrations that influence thermal experience or fluvial alterations that increase diurnal temperature variability. However, because the algorithms that describe the relationship between temperature and physiological rates (i.e., food consumption, metabolism) are often non-linear, using inputs in daily mean temperatures can under- or over-estimate physiological rates and create bias in model estimates of growth. Using simulation, we found that the non-linear temperature-dependent algorithms for consumption and respiration result in large differences between daily and sub-daily model estimates of growth when water temperatures approach the thermal optimum for the species. To correct for model bias in growth, we propose an integrated temperature-scaling algorithm that allows the daily model to be appropriately applied to systems where daily temperatures exhibit considerable sub-daily variation. This approach can also be used for any bioenergetics model that includes non-linear temperature-dependent algorithms, and should be considered when modeled temperatures approach inflection points in non-linear relationships.
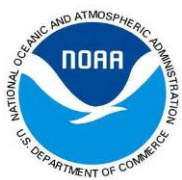
Accepted: 8 September 2015

Status of the world's baleen whales

Marine Mammal Science (1.936)

P.O. Thomas, R.R. Reeves, and **R.L. Brownell, Jr. (NMFS/SWFSC)**

- Comprehensive review of the status of global baleen whale populations

- Recommends that in order for the conservation of baleen whales to be successful, efforts should be focused at the population level

No global synthesis of the status of baleen whales has been published since the 2008 IUCN Red List assessments. Many populations remain at low numbers from historical commercial whaling, which had ceased for all but a few by 1989. Fishing gear entanglement and ship-strikes are the most severe current threats. The acute and long-term effects of anthropogenic noise and the cumulative effects of multiple stressors are of concern but poorly understood. The looming consequences of climate change and ocean acidification remain difficult to characterize. Southern right, bowhead, and gray whales have been assessed as Least Concern at the species level, but North Atlantic and North Pacific right whales and the Chile-Peru subpopulation of southern right whales are Critically Endangered as are two bowhead whale subpopulations and the western North Pacific subpopulation of gray whales. Some other baleen whale subpopulations are Endangered. Eastern North Pacific blue whales have reportedly recovered, but Antarctic blue whales remain at about 1 percent of pre-exploitation levels. Small isolated subspecies or subpopulations, such as Northern Indian Ocean blue whales, Arabian Sea humpback whales, and Mediterranean Sea fin whales are threatened while most subpopulations of sei, Bryde's, and Omura's whales are inadequately monitored and difficult to assess.
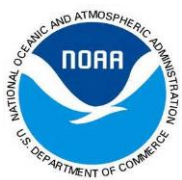Expected: January 2016

Bayesian logistic mixed-effects modelling of transect data: relating red tree coral presence to habitat characteristics
ICES Journal of Marine Science (2.525)
M. M. Masuda and **R. P. Stone (NMFS/AKFSC)**
- Demonstrated that the application of a hierarchical Bayesian logistic mixed-effects model was effective in relating the presence of red tree corals to habitat characteristics at two sites in the Gulf of Alaska.
- By identifying some of the important abiotic habitat characteristics related to red tree coral presence, the model developed in this study could potentially be used to predict red tree coral presence in large geographical regions detected by remote sensing to have those same characteristics.

The collection of continuous data on transects is a common practice in habitat and fishery stock assessments; however, the application of standard regression models

that assume independence to serially correlated data is problematic. We show that generalized linear mixed models (GLMMs), i.e. generalized linear models for longitudinal data, that are normally used for studies performed over time can also be applied to other types of clustered or serially correlated data. We apply a specific GLMM for longitudinal data, a hierarchical Bayesian logistic mixed-effects model (BLMM), to a marine ecology dataset obtained from submersible video recordings of the seabed on transects at two sites in the Gulf of Alaska. The BLMM was effective in relating the presence of red tree corals (*Primnoa pacifica*; i.e. binary data) to habitat characteristics: the presence of red tree corals is highly associated with bedrock as the primary substrate (estimated odds ratio 9 - 19), high to very high seabed roughness (estimated odds ratio 3 - 5), and medium to high slope (estimated odds ratio 2 - 3). The covariate depth was less important at the sites. We also demonstrate and compare two methods of model checking: full and mixed posterior predictive assessments, the latter of which provided a more realistic assessment, and we calculate the variance partition coefficient for reporting the variation explained by multiple levels of the hierarchical model. Published online: 18 September 2015

Available online:

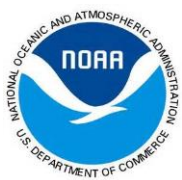http://icesjms.oxfordjournals.org/content/early/2015/09/17/icesjms.fsv163.full.pdf

First assessment of the sex ratio for an East Pacific green sea turtle foraging aggregation: validation and application of a testosterone ELISA
PLoS One (3.534)
C. D. Allen, M. N. Robbins, D. W. Owens, A. Meylan, P. Meylan, **N. M. Kellar, T. Eguchi**, J. Schwenter, H. Nollens, **P. H. Dutton,** and **J. A. Seminoff (NMFS/SWFSC)**

- We used a commercially available enzyme-linked immunosorbent assay and applied it to a wild aggregation of green sea turtles to provide the first estimate of sex ratio at a foraging ground in the eastern Pacific Ocean.
- Current sex ratio baseline information will be informative for predicting climate warming conservation concerns for sea turtles, and sex ratio information for each sea turtle species is vital for inferring population status and the survivorship of each sex.

Determining sex ratios of endangered populations is important for wildlife management, particularly species subject to sex-specific threats or that exhibit
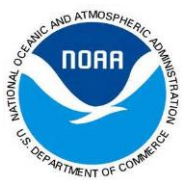
temperature-dependent sex determination. Sea turtle sex is determined by incubation temperature and individuals lack external sex-based traits until sexual maturity. Previous research utilized serum/plasma testosterone radioimmunoassays (RIA) to determine sex in immature/juvenile sea turtles. However, there has been a growing application of enzyme-linked immunosorbent assay (ELISA) for wildlife endocrinology studies, but no study on sea turtles has compared the results of ELISA and RIA. This study provides the first sex ratio for a threatened East Pacific green sea turtle (*Chelonia mydas*) foraging aggregation, a critical step for future management of this species. Here, we validate a testosterone ELISA and compare results between RIA and ELISA of duplicate samples. The ELISA demonstrated excellent correspondence with the RIA for providing testosterone concentrations for sex determination. Neither assay proved reliable for predicting the sex of reproductively active females with increased testosterone production. We then applied ELISA to examine the sex ratio of 69 green turtles foraging in San Diego Bay, California. Of 45 immature turtles sampled, sex could not be determined for three turtles because testosterone concentrations fell between the ranges for either sex (females: 4.1 – 113.1 pg/mL. males: 198.4 – 2,613.0 pg/mL) and these turtles were not subsequently recaptured to enable sex determination; using a Bayesian model to predict probabilities of turtle sex we predicted all three 'unknowns' were female (> 0.86). Additionally, the model assigned all turtles with their correct sex (if determined at recapture) with 100% accuracy. Results indicated a female bias (2.83F:1M) among all turtles in the aggregation; when focusing only on putative immature turtles the sex ratio was 3.5F:1M. With appropriate validation, ELISA sexing could be applied to other sea turtle species, and serve as a crucial conservation tool.
Expected publication date: Winter 2015/2016

Development and field testing a satellite-linked fluorometer for marine vertebrates
Animal Biotelemetry (NA)
M. E. Lander (NMFS/AKFSC), T. Lindstrom, M. Rutishauser, A. Franzheim, and M. Holland

- The instrument developed during this project will greatly improve the pace and efficiency of data collection while providing a greater understanding of how animals respond to their environment.

Understanding the responses of marine vertebrates to spatial and temporal variability of primary productivity is fundamental for their conservation and for predicting how they will be affected by climate change. Despite recent advances in biotelemetry, fluorometers have only recently been incorporated into larger transmitting systems. The purpose of this project was to incorporate a miniature fluorometer into a satellite-linked transmitter to provide measures of *in situ* phytoplankton fluorescence, which were used to calculate chlorophyll-*a* (chl-*a*), a proxy for primary productivity. Once laboratory and field trials indicated the interfaced archival prototype operated effectively and was robust to animal behavior, the instrument was deployed on a Steller sea lion (*Eumetopias jubatus*) captured at Adak, Alaska, on 9 October 2014. For three weeks, 188 messages were transmitted successfully for the first dive exceeding 9.5 m after the top of the hour and included: 1) the chl-*a* (μg/cl) and temperature (˚C) values at 3 m depth, 2) the maximum chl-*a* value and the depth at which it occurred, 3) the chl-*a* and temperature values at the maximum dive depth (including the depth value), and 4) individual summations of all chl-*a* and temperature values from the surface to the maximum depth of the dive. Although fluorescence quenching, bio-fouling, and additional calibration of the fluorometer warrant additional investigation, preliminary data indicated this instrument should be an effective means for providing sub-surface, *in situ* phytoplankton fluorescence (chl-*a*) relative to animal ecology.
Publication date: 2 October 2015
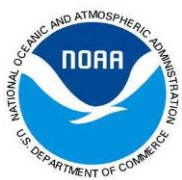Available online: http://www.animalbiotelemetry.com/content/3/1/40

Development of baited predation event recorders to quantify juvenile Chinook salmon predation in a river environment
Fishery Bulletin (1.783)
N. J. Demetras, D. D. Huff, C. J. Michel, J. M. Smith, **G. R. Cutter**, **S. A. Hayes**, and **S. T. Lindley (NMFS/SWFSC)**
- New and novel method to measure relative predation of juvenile Chinook salmon in freshwater habitats.
- Provides complementary data to ongoing juvenile Chinook tagging and survival studies in the CA Central Valley.

Calculating the effect of predation on juvenile Chinook salmon by piscivorous fishes within California's Sacramento-San Joaquin Delta has

traditionally relied upon acoustic tagging data and coded wire tag recoveries. However, these methods rely on survivorship of individuals over large spatial scales and are often unable to identify the exact cause or location of mortality. We designed, constructed, and tested freely floating, GPS-enabled predation event recorders (PERs) baited with juvenile Chinook salmon to estimate the relative predation rate and identify the locations of predation within a one kilometer reach of the Lower San Joaquin River. The relationship between time to predation and environmental variables (temperature, water velocity, conductivity, median depth, standard deviation of depth and light intensity) were modeled with a Cox proportional hazards analysis. Our results indicated that water velocity and the median depth of the PER path were related to the likelihood of predation. The mean relative predation rate in the study area was 15.3% for 216 PER tracks over nine sampling events between late March and late May, 2015. Waterproof video cameras attached to a subset of PERs visually confirmed predation events and successfully identified predator species 25% of the time. Our GPS-enabled PER was a reliable tool for quantifying predation that was: relatively inexpensive, reusable, provided specific spatial predation data, was easily managed by a two-person boat crew, and provided complementary data to acoustic telemetry and predator diet studies.
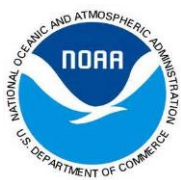Expected publication date: January - February 2016

OAR Publications
Forecasting impacts of Silver and Bighead Carp on the Lake Erie food web
Ecological Applications (4.126)
H. Zhang, E. S. Rutherford, D. M. Mason, J. T. Breck, M. E. Wittmann, R. M. Cooke, D. M. Lodge, J. D. Rothlisberger, X. Zhu, and T. B. Johnson
(OAR/GLERL)
- This paper demonstrates a novel approach for including uncertainty in forecasts of invasive species impacts on aquatic food webs, focusing on impacts of Asian Carp in the Great Lakes.
- The author's findings suggest Asian Carp would affect Lake Erie's food web by competing with other planktivorous fishes, and by providing additional prey for piscivores.

- Asian Carp invasion impacts could be greater than average in some parts of Lake Erie, but results in general suggest that lake-wide impacts on the Lake Erie food web are unlikely to be as great as some have feared.
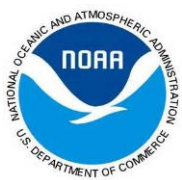
Nonindigenous bigheaded carps (Bighead Carp *Hypophthalmichthys nobilis*, Silver Carp *H. molitrix,* 'AC') threaten to invade and disrupt food webs and fisheries in the Laurentian Great Lakes, through their high consumption of plankton. To quantify potential food web effects by AC on Lake Erie, we developed an Ecopath with Ecosim (EwE) food web model and simulated four scenarios of variable AC diet composition (high, low, no detritus; low detritus with Walleye *Sander vitreus* and Yellow Perch *Perca flavescens* larvae), and two nutrient load scenarios (1999 baseline load, 2× baseline - 'HP'). We quantified uncertainty of potential AC effects by coupling the EwE model with estimates of parameter uncertainty in AC production, consumption, and predator diets obtained using structured expert judgment. Our model projected mean ± SD AC equilibrium biomass ranging from 52 ± 34 to 104 ± 75 kg/ha under different simulation scenarios. Relative to baseline simulations without AC, AC invasion under all detrital diet scenarios decreased biomass of most fish and zooplankton groups. AC effects in HP scenario were similar to effects in detrital diet scenarios, except that biomasses of most Walleye and Yellow Perch groups were increased under HP because these fishes were buffered from competition with AC by increased productivity at lower trophic levels. AC predation on Walleye and Yellow Perch larvae caused biomass declines of all Walleye and Yellow Perch groups. Large food web impacts of AC occurred in only 2% of simulations, where AC biomass exceeded 200 kg/ha resulting in biomass declines of zooplankton and planktivorous fish near levels observed in the Illinois River. Our findings suggest AC would affect Lake Erie's food web by competing with other planktivorous fishes, and by providing additional prey for piscivores. Our methods provide a novel approach for including uncertainty into forecasts of invasive species impacts on aquatic food webs.
Expected Publication date: online Mid-December

Perspective of transient tracer applications and limiting cases
Ocean Science (2.232)
T. Stöven, T. Tanhua, M. Hoppema, and **J. L. Bullister (OAR/PMEL)**

- This paper discusses techniques that use chlorofluorocarbons (CFCs) and several other trace gases to obtain improved estimates of the rates of ocean mixing and circulation processes.
- CFCs dissolve at the surface of the ocean and because they are entirely anthropogenic, they offer a unique opportunity to study rates at which the ocean can take up anthropogenic CO2 and heat.
- Distributions of observed tracers like CFCs can also be used to evaluate and improve numerical models of ocean circulation.
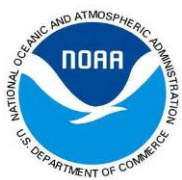
The concentrations of a number of radioisotopes and gases—including chlorofluorocarbons (CFCs), sulfur hexafluoride, and carbon dioxide (CO2)—have increased significantly in the atmosphere during the past century. These compounds dissolve in the surface ocean and are subsequently carried into the ocean interior, acting as "tracers" of complex oceanic mixing and circulation processes. Some of these compounds, such as CFCs, are entirely anthropogenic in origin (i.e., they are produced solely as a result of human activity). Studies of the changing distributions of dissolved CFCs in the ocean provide a unique and extremely sensitive tool to help estimate the rates at which the ocean can take up anthropogenic CO2 and heat. Observed tracer distributions can also be used to evaluate and improve numerical models of ocean circulation. International programs involving NOAA and other agencies are in place to monitor, at approximately 10-year increments, the evolving global distributions of a number of these tracers in the subsurface ocean. This paper discusses mathematical techniques that use CFCs along with several other tracers (with different time histories) to obtain improved estimates of the rates of ocean mixing and circulation processes, highlighting regions of the Southern Ocean where these tracer-based techniques are especially useful.
Expected Publication date: September 2015

The climate of the Pacific Arctic during the first RUSALCA decade 2004-2013
Oceanography (3.285)
K. R. Wood (OAR/CPO), J. A. Wang, S. A. Salo (OAR/PMEL), and P. Stabeno (OAR/GLERL)
- Describes the climate context for the first decade of RUSALCA (2004–2013).

- Provides additional analyses needed to relate observations obtained during three extended research expeditions.
- Results highlight the benefit and continuing need for sustained international and multidisciplinary collaboration in climate research, as exemplified by the RUSALCA program.

The Russian-American Long-term Census of the Arctic (RUSALCA) research program (2004–present) is being conducted during a period of rapid environmental change in the Arctic. With access to both sides of the international convention line, RUSALCA is uniquely positioned to monitor key regions of the Pacific Arctic, including Bering Strait and the western Chukchi Sea. This paper describes the climate context for the first decade of RUSALCA (2004–2013) and provides additional analyses needed to relate observations obtained during three extended research expeditions with seasonal and longer time-scale variations in sea ice concentration, weather, and ocean temperature patterns in the broader Pacific Arctic region. Results highlight the benefit and continuing need for sustained international and multidisciplinary collaboration in climate research, as exemplified by the RUSALCA program.
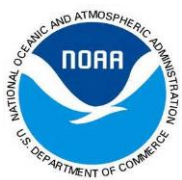Expected Publication Date: 30 September 2015

Changes in the Lake Michigan food web following dreissenid mussel invasions: A synthesis
Journal of Great Lakes Research (1.77)
C. P. Madenjian, D. B. Bunnell, D. M. Warner, **S. A. Pothoven**, G. L. Fahnenstiel, T. F. Nalepa, **H. A. Vanderploeg (OAR/GLERL)**, I. Tsehaye, R. M. Claramunt, and R. D. Clark

- Despite many negative changes driven by dreissenid mussels, there has been little impact on salmonines and whitefish.
- Mussel invasions were followed by declines in lake primary productivity.
- Predatory fish biomass remained stable following invasions, possibly due to counterbalancing shifts in food web dynamics.

Using various available time series for Lake Michigan, the authors examined changes in the Lake Michigan food web following the dreissenid mussel invasions, and identified those changes most likely attributable to these invasions. Expansion of the quagga mussel (*Dreissena rostriformis bugensis*) population into deeper waters, which began around 2004, appeared to have a substantial predatory effect

on both phytoplankton abundance and primary production. Annual primary production in offshore (> 50 m deep) waters was reduced by about 35% by 2007. Primary production likely decreased in nearshore waters as well, primarily due to predatory effects exerted by the quagga mussel expansion. The drastic decline in zooplankton (e.g. *Diporeia* spp.) abundance in Lake Michigan during the 1990s and 2000s has been attributed to dreissenid mussel effects, but the exact mechanism by which the mussels were negatively affecting *Diporeia* abundance remains unknown. In turn, declines in *Diporeia* abundance were associated with reduced condition, growth, and/or energy density in alewife (*Alosa pseudoharengus*), lake whitefish (*Coregonus clupeaformis*), deepwater sculpin (*Myoxocephalus thompsoni*), and bloater (*Coregonus hoyi*). However, lakewide biomass of salmonines, top predators in the food web, remained high during the 2000s, and consumption of alewives by salmonines actually increased between the 1980-1995 and 1996-2011 time periods. Moreover, abundance of the lake whitefish population, which supports Lake Michigan's most valuable commercial fishery, remained at historically high levels during the 2000s. Counterbalancing mechanisms operating within the complex Lake Michigan food web may have enabled salmonines and lake whitefish to retain relatively high abundances despite reduced primary production.
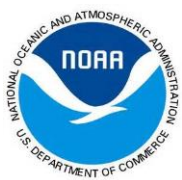Expected Publication Date: November 2015

Estimating diffusivity from the mixed layer heat and salt balances in the North Pacific
Journal of Geophysical Research: Oceans (3.44)
M.F. Cronin, N.A. Pelland, S.R. Emerson, and W.R. Crawford **(OAR/PMEL)**
- Provides evidence for strong seasonal and geographic patterns in the diffusivity corresponding to the diffusive flux at the base of the surface mixed layer.

Data from two National Oceanographic and Atmospheric Administration (NOAA) surface moorings in the North Pacific, in combination with data from satellite, Argo floats and glider (when available), are used to evaluate the residual diffusive flux of heat across the base of the mixed layer from the surface mixed layer heat budget. The diffusion coefficient (i.e., diffusivity) is then computed by dividing the diffusive flux by the temperature gradient in the 20-m transition layer just below the base of the mixed layer. At Station Papa in the NE Pacific subpolar gyre, this

diffusivity is $1 \times 10{-}4$ m2/s during summer, increasing to ~$3 \times 10{-}4$ m2/s during fall. During late winter and early spring, diffusivity has large errors. At other times, diffusivity computed from the mixed layer salt budget at Papa correlate with those from the heat budget, giving confidence that the results are robust for all seasons except late winter-early spring and can be used for other tracers. In comparison, at the Kuroshio Extension Observatory (KEO) in the NW Pacific subtropical recirculation gyre, somewhat larger diffusivities are found based upon the mixed layer heat budget: ~ $3 \times 10{-}4$ m2/s during the warm season and more than an order of magnitude larger during the winter, although again, wintertime errors are large. These larger values at KEO appear to be due to the increased turbulence associated with the summertime typhoons, and weaker wintertime stratification.
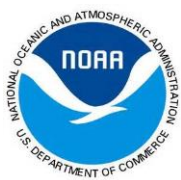
Seasonality of tropical Pacific decadal trends associated with the 21st century global warming hiatus
Journal of Geophysical Research (3.44)
D.J. Amaya, S.-P. Xie, A.J. Miller, and **M.J. McPhaden (OAR/PMEL)**
- In this study Equatorial Pacific changes during the transition from a non-hiatus period (pre-1999) to the present global warming hiatus period (post-1999) are identified using a combination of reanalysis and observed data sets.
- Changes include: Tropical Pacific wind-driven ocean circulation intensified transitioning to hiatus; Decadal anomalies of SST and ocean circulation display strong seasonality; Seasonality due to variations in wind stress and zonal temperature advection.
- An improved dynamical understanding of how the tropical Pacific Ocean responds during transitions into hiatus events, including its seasonal structure, may help to improve future predictability of decadal climate variations.

Equatorial Pacific changes during the transition from a non-hiatus period (pre-1999) to the present global warming hiatus period (post-1999) are identified using a combination of reanalysis and observed data sets. Results show increased surface wind forcing has excited significant changes in wind-driven circulation. Over the last two decades, the core of the Equatorial Undercurrent intensified at a rate of 6.9 cm s−1 decade−1. Similarly, equatorial upwelling associated with the shallow meridional overturning circulation increased at a rate of 2.0 x 10−4 cm s−1

decade−1 in the central Pacific. Further, a seasonal dependence is identified in the sea surface temperature trends and in subsurface dynamics. Seasonal variations are evident in reversals of equatorial surface flow trends, changes in subsurface circulation, and seasonal deepening/shoaling of the thermocline. Anomalous westward surface flow drives cold-water zonal advection from November to February, leading to surface cooling from December through May. Conversely, eastward surface current anomalies in June-July drive warm-water zonal advection producing surface warming from July to November. An improved dynamical understanding of how the tropical Pacific Ocean responds during transitions into hiatus events, including its seasonal structure, may help to improve future predictability of decadal climate variations.
Accepted: October 2015

OTHER REPORTS, BOOK CHAPTERS, AND INTERNAL PUBLICATIONS
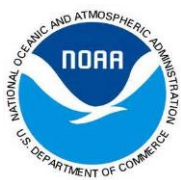
NOS PUBLICATIONS

NOAA guidance document for determination of vertical land motion at water Level stations using GPS technology
NOAA Technical Report
S. Gill (NOS/COOP&SVC), **N. Weston (NOS/NGS)**, and **D. Smith (NOS/NGS)**
- An approach to identify vertical land motion and sea-level change at tide stations with nearby CORS is documented.
- This document provides operational guidance for determining rates of vertical land motion at the location of water level stations and specifically for co-location of CORS and long-term water level stations for that purpose.

To estimate absolute sea-level variability from water level station records, both the sea level variations and the vertical land motion must be analyzed in the same geocentric reference frame (Plag et al., 2013, Bevis et al, 2002). Long-term water level station records do not directly provide this information because tide gauge records measure relative sea-level variations that include contributions from vertical land motion, among others. CO-OPS recently published a technical report on estimating vertical land motion from long-term tide station records (Zervas, et al., 2013). This indirect estimation provides information at locations at which Continuously Operating Reference Station (CORS) stations have not yet been

established nor survey connections made. The methodology is operationally being used in sea-level change calculators (USCGRP, 2013) while awaiting the co-located GPS connection discussed in this report. Other technologies being used to estimate vertical land motion include use of InSAR space geodesy technology (Brooks et al, 2007). However InSAR does not automatically provide geocentric height variations unless it is merged with cGPS stations (see, e.g. Hammond et al., 2011).

Published: September 2015